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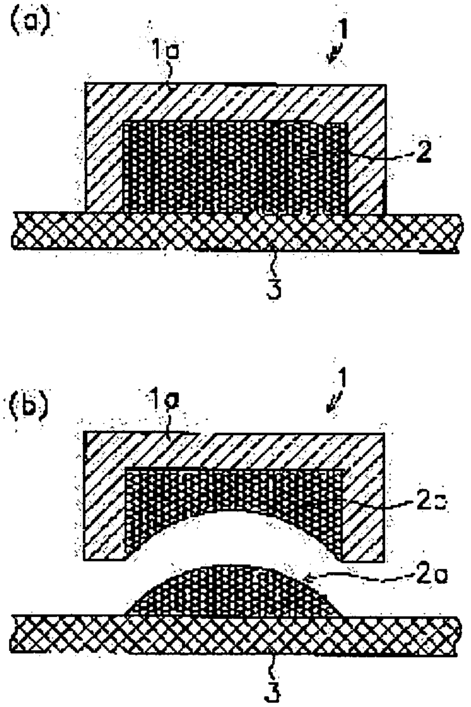
(54) CONDUCTIVE PASTE FOR INTAGLIO PRINTING

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a conductive paste that enables the formation of a concave board to be highly precise and accurate electrode lines even by intaglio printing.
SOLUTION: A conductive paste for intaglio printing is composed of a conductive powder, glass frit, and an organic vehicle. The conductive powder comprises almost spherical particles having a coagulation rate of not more than 6.0%, tap density of not less than 3.0 g/cm3, average particle size (D50) of 0.3-3.0 μm, and specific surface of 0.3-2.5 m2/g.



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CLAIMS

[Claim(s)]
[Claim 1] abbreviation whose rate of condensation contain conductive powder, a glass frit, and an organic vehicle, and said conductive powder has in within the limits 0.3-3.0 micrometers and whose specific surface area three or more 3.0 g/cm and mean particle diameter (D50) are 0.3-2.5m2/g for tap density 6.0% or less -- the conductive paste for intaglio printing characterized by consisting of spherical powder.
[Claim 2] The mean particle diameter (D50) of said glass frit is electrode paste for intaglio printing according to claim 1 characterized by being 2.5 micrometers or less.
[Claim 3] The addition of said glass frit is electrode paste for intaglio printing according to claim 1 or 2 characterized by being 2.0 - 8.0 % of the weight in 100 % of the weight of conductive pastes.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the conductive paste for intaglio printing used suitable for electrode circuit formation of electronic parts and an image display device.
[0002]
[Description of the Prior Art] The conventional intaglio printing is shown and explained to drawing 2 (a). First, intaglio-printing equipment 1 equipped with intaglio 1a by which the crevice was formed in the center section, the more common conductive paste 12 than the former which mainly consists of conductive powder, a glass frit, and an organic vehicle, and a substrate 3 are prepared. Next, it is filled up with the conductive paste 12 inside intaglio 1a. Next, as shown in drawing 2 (a), intaglio 1a is forced on a substrate 3 so that the conductive paste 12 and substrate 3 with which the crevice of intaglio 1a was filled up may touch. Next, as shown in drawing 2 (b), by removing intaglio 1a from a substrate 3, some conductive pastes 12 with which the crevice of intaglio 1a was filled up are imprinted on a substrate 3, electrode Rhine 12a is formed, and remainder 12b remains in the crevice of intaglio 1a to coincidence.
[0003] Moreover, JP,11-58922,A has a publication about the printing approach which forms electrode wiring by offset printing which is one gestalt of intaglio printing, and organic metal resinate is mentioned to it as a conductive paste used.
[0004]
[Problem(s) to be Solved by the Invention] Although the conventional intaglio printing is the technique of the ability to print electrode Rhine comparatively easily, since it is hard to distribute the conductive powder used as a filler to homogeneity, as shown in drawing 2 (b), it has the problem that the configuration of electrode Rhine 12a after an imprint does not become homogeneity. That is, since the internal linkage condition in the conductive paste 12 becomes unequal and association is destroyed from a weak part when the conductive powder under conductive paste 12 is not distributing to homogeneity, the boundary of electrode Rhine 12a and remainder 12b is divided by the ununiformity, therefore the configuration of electrode Rhine 12a after an imprint serves as an ununiformity.
[0005] Moreover, although high definition electrode Rhine can be formed by using organic metal resinate as a conductive paste, when forming the circuit of electronic parts and a display, in order to realize reservation and low-cost-izing of dependability to coincidence, organic metal resinate has the problem that cost starts too much.
[0006] Moreover, although there are screen printing and a FOTORISO method of construction as the electrode formation approach by thick film paste, screen-stencil has anxiety in the precision at the time of continuation printing, and it is not desirable [a FOTORISO method of construction] in order to require cost.
[0007] The purpose of this invention was made that an above-mentioned trouble should be canceled, and is to offer the conductive paste which can form highly minute and highly precise electrode Rhine also by intaglio printing.
[0008]
[Means for Solving the Problem] abbreviation whose rate of condensation the conductive paste for intaglio printing of this invention contains conductive powder, a glass frit, and an organic vehicle, and conductive powder has in within the limits 0.3-3.0 micrometers and whose specific surface area three or more 3.0 g/cm and mean particle diameter (D50) are 0.3-2.5m2/g for tap density 6.0% or less in order to attain the above-mentioned purpose -- it is characterized by consisting of spherical powder.
[0009] Moreover, mean particle diameter (D50) of the glass frit in the conductive paste for intaglio printing of this invention is characterized by being 2.5 micrometers or less.
[0010] Moreover, the addition of the glass frit in the conductive paste for intaglio printing of this invention is characterized by being 2 - 8 % of the weight in 100 % of the weight of conductive pastes.

[0011]

[Embodiment of the Invention] Intaglio printing using the conductive paste of this invention is shown and explained to drawing 1 (a). First, intaglio-printing equipment 1 equipped with intaglio 1a by which the crevice was formed in the center section, the conductive paste 2 of this invention, and a substrate 3 are prepared. Next, it is filled up with the conductive paste 2 inside intaglio 1a. Since the conductive powder under conductive paste 2 is distributing to homogeneity at this time, it fills up with conductive powder to all the corners of the crevice of intaglio 1a.

[0012] Next, as shown in drawing 1 (a), intaglio 1a is forced on a substrate 3 so that the conductive paste 2 and substrate 3 with which the crevice of intaglio 1a was filled up may touch. Next, as shown in drawing 1 (b), by removing intaglio 1a from a substrate 3, the conductive paste 2 with which the crevice of intaglio 1a was filled up is imprinted on a substrate 3, electrode Rhine 2a is formed, and remainder 2b remains in the crevice of intaglio 1a to coincidence. Since the conductive powder under conductive paste 2 is distributing to homogeneity at this time, the internal linkage condition in the conductive paste 12 becomes equal, and the boundary of electrode Rhine 12a and remainder 12b is divided by homogeneity, therefore the configuration of electrode Rhine 12a after an imprint serves as homogeneity.

[0013] The conductive powder used for the conductive paste of this invention requires that the rate of condensation is 6.0% or less. That is, if the rate of condensation exceeds 6.0%, condensation structure will not fully be cracked at the time of manufacture of a conductive paste, but the particle size of the appearance by the secondary particle under conductive paste will become large, and the configuration of electrode Rhine which the details of an intaglio are no longer filled up with conductive powder, and is imprinted will tend to become uneven.

[0014] Moreover, the conductive powder used for the conductive paste of this invention requires that tap density is three or more 3.0 g/cm. That is, since whenever [condensation / of the grain child whose tap density is less than three 3.0 g/cm] increases, the configuration of electrode Rhine which the details of an intaglio are no longer filled up with the conductive powder under conductive paste at the time of the process of intaglio printing, and is printed tends to become uneven.

[0015] Moreover, it requires that the conductive powder used for the conductive paste of this invention is range whose mean particle diameter (D50) is 0.3-3.0 micrometers. That is, when mean particle diameter (D50) is less than 0.3 micrometers, the primary particle of conductive powder condenses, although it is a particle therefore, since it is firm, condensation structure is not fully cracked at the time of manufacture of a conductive paste, but the particle size of the appearance by the secondary particle under conductive paste becomes large, and the condensation structure has the inclination for the details of an intaglio to no longer be filled up with conductive powder. Moreover, if mean particle diameter (D50) exceeds 3.0 micrometers, the configuration of electrode Rhine which the details of an intaglio are no longer filled up with the conductive powder under conductive paste at the time of the process of intaglio printing, and is printed will tend to become uneven.

[0016] Moreover, it requires that the conductive powder used for the conductive paste of this invention is range whose specific surface area is 0.3-2.5m2/g. That is, if specific surface area is less than 0.3m2/g, since mean particle diameter will become excessive, the configuration of electrode Rhine which the details of an intaglio are no longer filled up with the conductive powder under conductive paste at the time of the process of intaglio printing, and is printed tends to become uneven. Moreover, if specific surface area exceeds 2.5m2/g, since mean particle diameter will become [too little], the primary particle of conductive powder condenses, although it is a particle therefore, since it is firm, condensation structure is not fully cracked at the time of manufacture of a conductive paste, but the particle size of the appearance by the secondary particle under conductive paste becomes large, and the condensation structure has the inclination for the details of an intaglio to no longer be filled up with conductive powder.

[0017] Although the glass frit used for the conductive paste of this invention does not carry out especially limitation, B-Si-Bi-O system glass, B-Si-Zn-O system glass, B-Si-Ba-O system glass, B-Si-Pb-O system glass, etc. can be chosen suitably, and can be used for it, for example.

[0018] Moreover, as for the mean particle diameter (D50) of the glass frit used for the conductive paste of this invention, it is desirable that it is 2.5 micrometers or less. Generally, since surface roughness will get worse if particle size becomes large, since a glass frit is an indeterminate form, the configuration of electrode Rhine printed tends to become uneven. Moreover, although the problem resulting from the configuration of a glass particle is somewhat solvable by using spherical glass powder, a production cost will become high if spherical glass impalpable powder is used. On the other hand, when, as for this invention, mean particle diameter (D50) uses a glass frit 2.5 micrometers or less, it fills up with the conductive powder under conductive paste even at the details of an intaglio at the time of the process of intaglio printing, and the configuration of electrode Rhine printed serves as homogeneity.

[0019] Moreover, as for the addition of the glass frit used for the conductive paste of this invention, it is desirable that it is 2 - 8 % of the weight to 100 % of the weight of conductive pastes. That is, if an addition is 2 % of the weight or more, the adhesion over the substrate of printed electrode Rhine is more securable. Moreover, if an addition is 8 or less % of the weight, since superfluous glass will not come up to the front face of the electrode after baking, solder wettability is securable.

[0020] Although the organic vehicle used for the conductive paste of this invention does not carry out especially limitation, it can choose suitably that in which resin, such as oils, such as vegetable oil, a processing oil, and straight mineral oil, and natural resin, rosin denaturation phenol resin, petroleum resin, alkyd resin, and cyclized rubber, was dissolved as the aliphatic hydrocarbons or the aromatic hydrocarbons solvent generally used, for example in the ink of offset printing and water-less printing, and can use it for it. Moreover, additives, such as a wax, a dryer, a dispersant, a misting inhibitor, and an anti-skinning agent, can be added suitably if needed.

[0021]

[Example] First, as shown in Table 1, the end of silver dust a powder configuration, tap density, and mean particle diameter differ from specific surface area, respectively was prepared, and these were made into a sample 1 thru/or the silver dust end of 14, respectively.

[0022] In addition, the powder configuration was made into "the shape of "massive" and a scale" based on the configuration which average circularity made "spherical" 90% or more of powder, in addition was observed. Average circularity was taken as the ratio which **(ed) the boundary length of the circle equivalent to the area of a particle projection image by the boundary length of the projection image. Moreover, the condensation number made the rate of condensation the rate which **(ed) the particle number of five or more pieces with the total particle number. On the occasion of the above measurement, the flow type dispersoid analysis equipment made from cis- MEKKUSU (FPIA-2000) was used.

[0023] Next, 67 weight sections, the B-Si-Bi-O system glass frit 3 weight section, and the vehicle (SP-215: SAKATA INX make) 30 weight section were kneaded, respectively, 3 rolls distributed a sample 1 thru/or the silver dust end of 14, and the sample 1 thru/or the conductive paste of 14 were produced.

[0024] Next, the crevice of the intaglio of the straight-line pattern which has the king section with a width-of-face [of 50 micrometers] x depth of 20 micrometers was filled up with the sample 1 thru/or the conductive paste of 14, this was printed to the glass substrate, and a sample 1 thru/or electrode Rhine of 14 were formed.

[0025] Then, the configuration of a sample 1 thru/or the restoration nature to the intaglio of the conductive paste of 14 and a sample 1 thru/or electrode Rhine of 14 was observed.

[0026]

[Table 1]

試料	粉末形状	凝集率 (%)	タップ密度 (g/cm^3)	平均粒径 D50(μm)	比表面積 (m^2/g)	充填性	転写形状	評価
1	球状	1.8	4.0	0.3	1.9	◎	均一	◎
2	球状	2.5	3.4	0.7	2.5	◎	均一	◎
3	球状	0.8	4.9	1.5	0.8	◎	均一	◎
4	球状	1.5	4.6	1.7	0.8	◎	均一	◎
5	球状	0.6	4.7	3.0	0.3	○	均一	○
6	球状	0.6	4.2	3.5	0.3	×	—	×
7	球状	10.5	3.8	1.0	2.7	×	—	×
8	球状	6.0	4.4	1.7	1.0	○	均一	○
9	球状	13.5	1.0	0.3	5.8	×	—	×
10	球状	1.4	3.0	1.5	1.0	◎	均一	◎
11	球状	5.0	2.8	0.9	2.5	×	—	×
12	球状	2.3	3.2	0.2	2.3	×	—	×
13	塊状	0.9	4.8	3.0	0.9	×	不均一	×
14	鱗片状	計測不可	4.3	3.6	0.7	×	—	×

[0027] sample 1- among the samples [rate / of condensation / tap density / 6.0% or less and / specific surface area] three or more 3.0 g/cm and mean particle diameter (D50) were using 0.3-3.0 micrometers by 0.3-2.5m2/g, and using the end of silver dust where a powder configuration is spherical so that clearly from Table 1 -- each of 4 and 10 was excellent in restoration nature, and the printing configuration was uniform.

[0028] moreover, sample 1- which the sample 5 whose mean particle diameter (D50) was 3.0 micrometers excels in ****** similarly although the conditions of an above-mentioned rate of condensation, tap density, mean particle diameter, specific surface area, and powder configuration are fulfilled -- although restoration nature was a little inferior compared with 4 and 10, since the printing configuration was within the limits which is uniform and is equal to practical use, it became within the limits of this invention.

[0029] moreover, sample 1- which the sample 8 whose rate of condensation was 6.0% excels in ****** similarly although the conditions of an above-mentioned rate of condensation, tap density, mean particle diameter, specific surface area, and powder configuration are fulfilled -- although restoration nature was a little inferior compared with 4 and 10, since the printing configuration was within the limits which is uniform and is equal to practical use, it became within the limits of this invention.

[0030] On the other hand, even the details of an intaglio were not filled up with the electric conduction powder under conductive paste, and the imprint configuration of the samples 6, 7, 9, 11-14 which do not fulfill the conditions of an above-mentioned rate of condensation, tap density, mean particle diameter, specific surface area, and powder configuration was not inferior and practical, either. If restoration nature was bad and resulted in the sample 14 using the silver dust end of the shape of a scale, it was not able to be filled up especially with the sample 13 using the massive end of silver dust at all to a crevice.

[0031]

[Effect of the Invention] The conductive paste of this invention contains conductive powder, a glass frit, and an organic vehicle as mentioned above. Said conductive powder abbreviation whose rate of condensation tap density has in within the limits 0.3-3.0 micrometers and whose specific surface area 3 or more [3.0g //cm] and mean particle diameter (D50) are 0.3-2.5m2/g 6.0% or less -- by it being characterized by consisting of spherical powder Highly minute and highly precise electrode Rhine can be formed also by the comparatively easy printing approach of intaglio printing, and the reservation and low-cost-izing of the dependability of an electrode which are formed can be realized to coincidence.

[0032] Moreover, as for the conductive paste of this invention, the mean particle diameter (D50) of the glass frit under conductive paste can realize further low cost-ization of the electrode which can form highly minute and highly precise electrode Rhine also with the cheap glass powder of an indeterminate form, and is formed by it being characterized by being 2.5 micrometers or less.

[0033] Moreover, since the adhesion over the substrate of printed electrode Rhine is secured more and superfluous glass does not come up to the front face of the electrode after calcinating to coincidence by it being characterized by being 2.0 - 8.0 % of the weight while the addition of the glass frit under conductive paste is 100 % of the weight of conductive pastes, the conductive paste of this invention can form highly minute and highly precise electrode Rhine which secured sufficient solder wettability.

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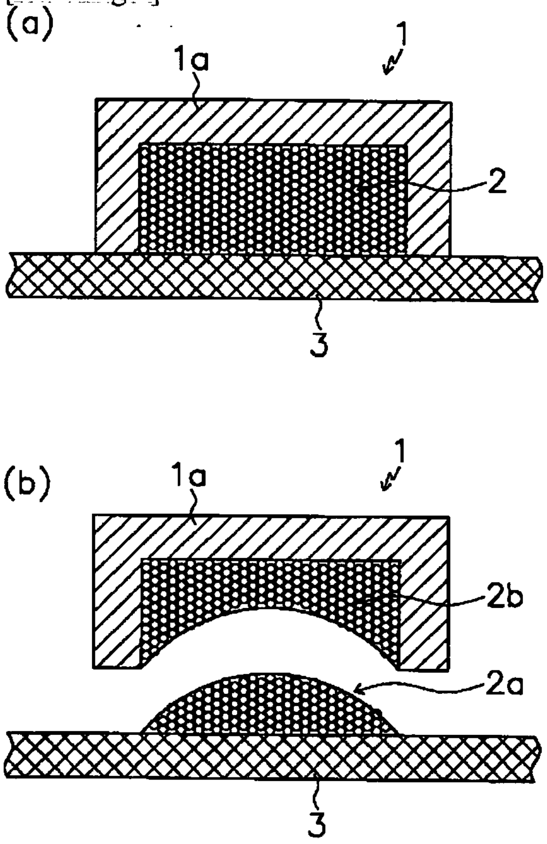
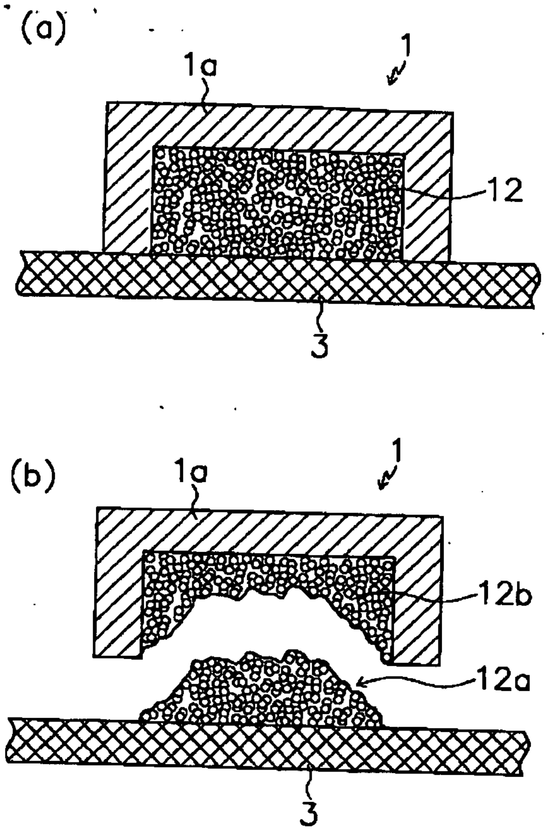
DRAWINGS

[Drawing 1]



[Drawing 2]



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